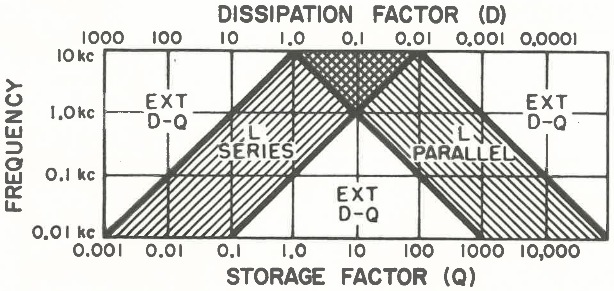
esi® Engineering Bulletin
Electro Scientific Industries
7524 S. W. MACADAM AVE. • PORTLAND 19, OREGON

BRIDGES AND ACCESSORIES
no. 11

MAY 1962
REPLACES MAY 1958

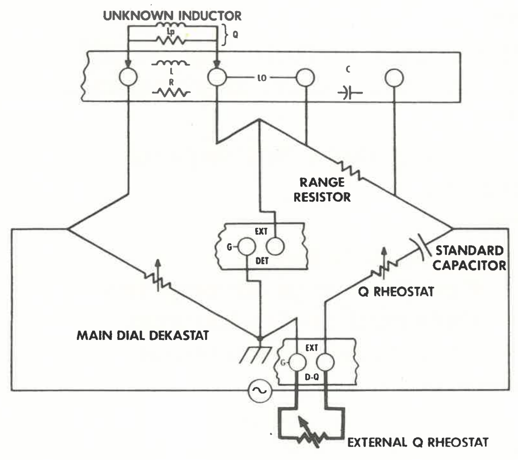
TO USE AN EXTERNAL Q RHEOSTAT FOR INDUCTANCE MEASUREMENTS WITH THE ESI MODEL 250 BRIDGE

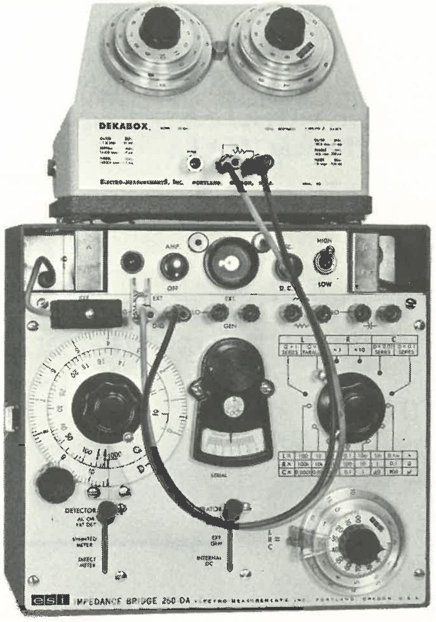
The D and Q ranges of the bridge can be extended by use of an external rheostat. The curve below shows the ranges of D and Q for which this technique is advisable.



ALWAYS SET THE CIRCUIT SELECTOR TO L PARALLEL.	This bridge circuit gives the best results for both the series and parallel bridge connections when using an external D-Q rheostat.
ALWAYS TURN THE D-Q DIAL CLOCKWISE UNTIL IT HITS THE MECHANICAL STOP AND LEAVE IT THERE DURING THE ENTIRE MEASUREMENT.	This shorts out the internal D-Q rheostat.

PARALLEL INDUCTANCE BRIDGE





©Copyright 1962 by Electro Scientific Industries, Inc.
LITHO IN U.S.A.

REPLACE THE EXT D-Q JUMPER BY AN EXTERNAL RHEOSTAT "R".

This completes the parallel inductance circuit.

BALANCE THE BRIDGE.

Use the range switch, the MAIN DIALS and the external rheostat.

READ L_P(EQUIVALENT PARALLEL INDUCTANCE) FROM THE DIALS.

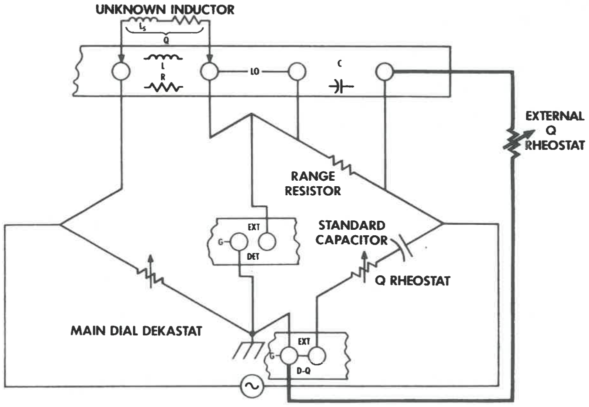
This reading does not depend on frequency.

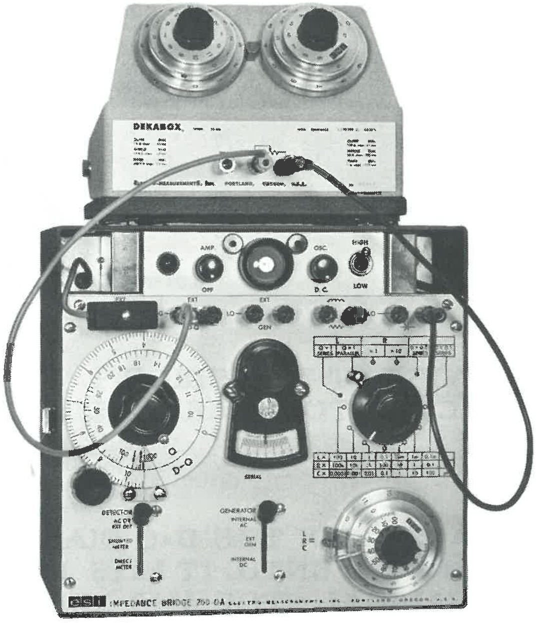
CALCULATE Q

$$Q = \frac{1.592}{f_{kc} R_k}$$

Q - Storage factor
f_{kc} - Frequency in kilocycles
R_k - External D-Q rheostat resistance in kilohms.

SERIES INDUCTANCE BRIDGE





CONNECT AN EXTERNAL RHEOSTAT "R" BETWEEN THE HI "C" TERMINAL AND ANY GROUND TERMINAL.

This completes the series inductance circuit. Be sure the EXT D-Q terminals are jumpered.

BALANCE THE BRIDGE.

Use the range switch, the MAIN DIALS and the external rheostat.

READ L_S (EQUIVALENT SERIES INDUCTANCE) FROM THE DIALS.

This reading does not depend on frequency.

CALCULATE Q

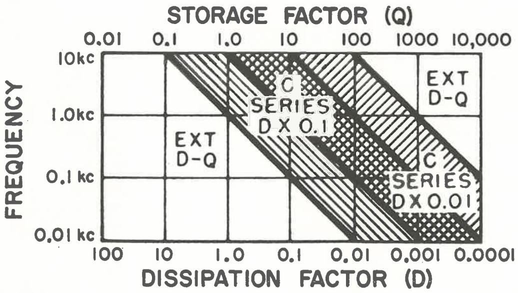
$$Q = 0.628\ f_{kc} R_k$$

Q - Storage factor
f_{kc} - Frequency in kilocycles
R_k - External D-Q rheostat resistance in kilohms.

Note: $L_p = \frac{1 + Q^2}{Q^2}\ L_s$

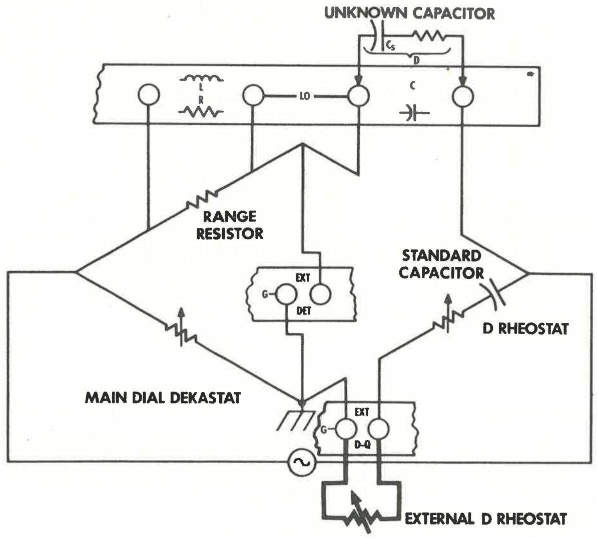
TO USE AN EXTERNAL D-Q RHEOSTAT FOR CAPACITANCE MEASUREMENTS WITH THE ESI MODEL 250 BRIDGE

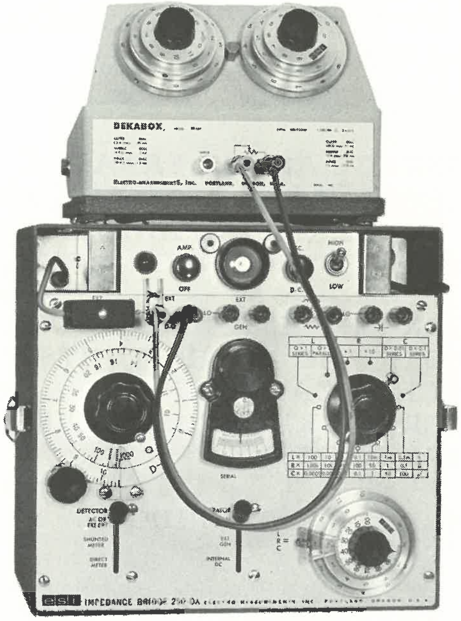
The D and Q ranges of the bridge can be extended by use of an external rheostat. The curve below shows the ranges of D and Q for which this technique is advisable.



SET THE CIRCUIT SELECTOR TO C SERIES	This bridge circuit can be used for both series and parallel connections when using an external D-Q rheostat.

SERIES CAPACITANCE BRIDGE





REPLACE THE EXT D-Q JUMPER BY AN EXTERNAL RHEOSTAT "R".	This completes the capacitance circuit series.
BALANCE THE BRIDGE.	Use the range switch, the MAIN DIALS and the external rheostat.
READ C_s (EQUIVALENT SERIES CAPACITANCE) FROM THE DIALS.	This reading does not depend on frequency.
CALCULATE D	

$$D = 0.628\, f_{kc}\, R_k + D_{dial\ reading}\, f_{kc}$$

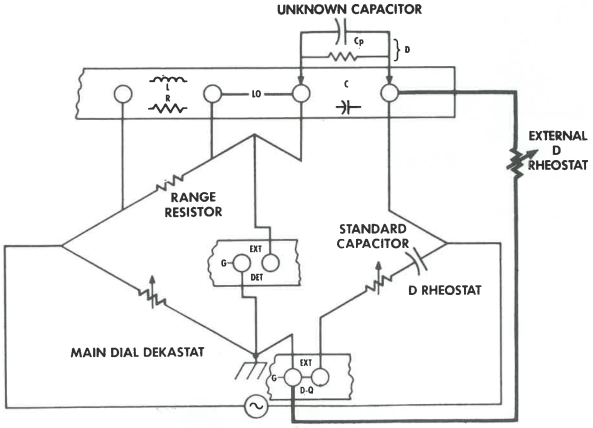
D - Dissipation factor in per unit

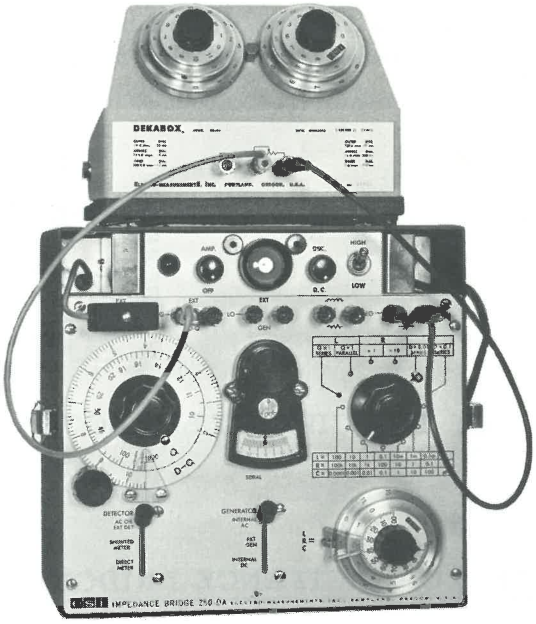
f_{kc} - Frequency in kilocycles

R_k - External D-Q rheostat resistance in kilohms.

D_{dial} - D-Q dial reading in divisions

PARALLEL CAPACITANCE BRIDGE





CONNECT AN EXTERNAL RHEOSTAT "R" BETWEEN THE HI "C" TERMINAL AND THE EXT D-Q TERMINAL MARKED G.	This completes the parallel capacitance bridge.
TURN THE D-Q DIAL COUNTER-CLOCKWISE UNTIL IT HITS THE MECHANICAL STOP AND LEAVE IT THERE DURING THE ENTIRE MEASUREMENT.	This shorts the internal D-Q rheostat.
BALANCE THE BRIDGE.	Use the range switch, the MAIN DIALS and the external rheostat.
READ C_p (EQUIVALENT PARALLEL CAPACITANCE) from the dials.	This reading does not depend on frequency.

CALCULATE D

$$D = \frac{1.592}{f_{kc} R_k}$$

D - Dissipation factor in per unit
f_{kc} - Frequency in kilocycles
R_k - External D-Q rèheostat resistance in kilohms.

$$C_p = \frac{C_s}{(1 + D^2)}$$